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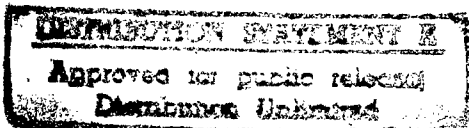
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MASS SPECTROGRAPHIC ASSIGNMENT OF RUBIDIUM ISOTOPES

by

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MASS SPECTROGRAPHIC ASSIGNMENT OF RUBIDIUM ISOTOPES

By Frederick L. Reynolds, D. C. Karraker, and David H. Templeton

We have used a mass spectrograph to investigate rubidium isotopes produced by bombardment of bromine (ammonium bromide) with helium ions in the Berkeley 60-inch and 184-inch cyclotrons. The 60°-deflection spectrograph is similar to that of Lewis and Hayden¹ but with larger dimensions and all-metal construction.*

In each bombardment with 20 to 100 Mev helium ions, there was a good yield of rubidium activity with half-life of about 6 hours. The rubidium activities were separated from the target material, using 20 to 30 micrograms of inactive rubidium carrier, and divided into two portions. One part was further purified and used for decay and absorption measurements. The other major portion was placed on the tungsten filament of the mass spectrograph as the nitrate or chloride. The Rb⁺ ions produced by heating this filament were analyzed by the instrument and caught on a photographic plate. The mass scale was fixed by the lines of stable Rb⁸⁵ and Rb⁸⁷. Lines at masses 81 and 82 were shown to be radioactive both by the photographic transfer technique (Figure 1) and by counting with a Geiger counter provided with a narrow slit. With 80-Mev helium ions, 5.0-hour Rb⁸¹ predominated in the mixture, and with 20-Mev helium ions, almost-pure 6.3-hour Rb⁸² was obtained. Otherwise, the similar half-lives would have made characterization of the radiations, which are listed in Table 1, very difficult. The signs of the particles were determined with a crude 180°-deflection beta spectrograph. The energies listed in Table 1 were obtained with this instrument or from absorption measurements with aluminum, beryllium, or lead, as indicated.

Table 1. Radiations from rubidium isotopes.

| Isotope | Half life | Radiations | e ⁻ /β ⁺ ratio |
|------------------|-----------|----------------------------------|--------------------------------------|
| Rb ⁸¹ | 5.0 hours | β ⁺ 0.7 Mev (abs. Al) | ~1 |
| | | e ⁻ 0.2 Mev (spect.) | |
| | | γ 0.8 Mev (abs. Pb) | |
| | | K x-rays (abs. Al, Be) | |
| Rb ⁸² | 6.3 hours | β ⁺ 0.6 Mev (abs. Al) | <0.02 |
| | | γ 1.0 Mev (abs. Pb) | |
| | | K x-rays (abs. Al, Be) | |
| | | | |

The previously reported² 6.5-hour rubidium activity assigned to Rb⁸⁴ was presumably Rb⁸² or a mixture of Rb⁸² and Rb⁸¹. No description of the radiations was reported.

Attempts to observe a krypton daughter of Rb⁸¹ have shown no positive results. Experiments are under way to characterize some longer-lived activity produced in these same bombardments, due to Rb⁸³ and perhaps Rb⁸⁴. Barber³ has reported a 40-day positron emitter which he attributed to Rb⁸⁴.

*We are greatly indebted to Dr. A. J. Dempster, Dr. M. G. Inghram, and Dr. R. J. Hayden for information and advice concerning their techniques and the design of this instrument.

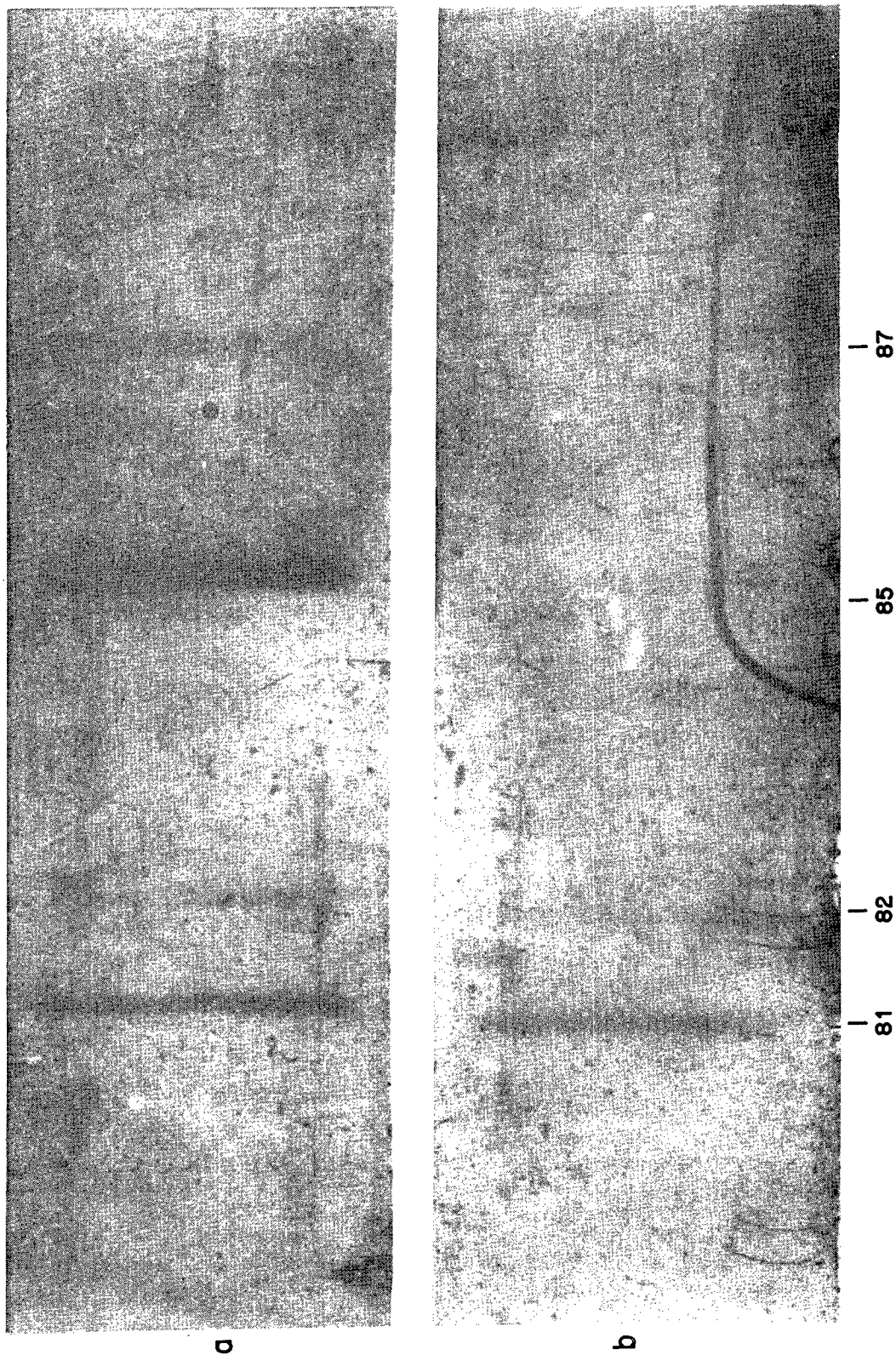


Figure 1. The original plate shows stable Rb⁸⁵ and Rb⁸⁷ and radioactive Rb⁸¹ and Rb⁸². The "transfer" plate is placed emulsion-to-emulsion with the original for several hours before either is developed, to locate radioactive material.

ACKNOWLEDGMENTS

The cooperation of J. T. Vale, B. Rossi, and the crews of the 184-inch and 60-inch cyclotrons is gratefully acknowledged.

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